

**Report on the Third Meeting of the
International Committee on Global Navigation Satellite Systems (ICG)**
Pasadena, California, USA, 8 to 12 December 2008

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Introduction

The International Committee on Global Navigation Satellite Systems (ICG), met in Pasadena, California, USA, from 8 to 12 December 2008. Vice President Matt Higgins attended representing the International Federation of Surveyors (FIG).

The ICG has been formed as a result of recommendations of the UN Committee on the Peaceful Use of Outer Space (COPUOS), as ratified by the General Assembly of the UN. The United Nations Office for Outer Space Affairs (UN OOSA) acts as the secretariat for the ICG. It should be noted that FIG has an MoU with UN OOSA.

A major development for the surveying and geodesy community at ICG-3 was the formation of a Task Force on Geodetic References. The proposed membership of the Task Force means that for the first time ever, there will be a single forum where experts from the user community (including FIG and the International Association of Geodesy- IAG) can meet directly with experts from the GNSS providers who are responsible for:

- World Geodetic System 84 (WGS84) used for GPS;
- PZ-90.02 used for GLONASS;
- Galileo Terrestrial Reference Frame (GTRF) used for Galileo, and;
- China Geodetic System (CGS`2000) used for Compass.

The goals for the Task Force will include:

- a. To bring together all interested ICG participants (experts from the system and service providers, key user communities, etc);
- b. To review the present situation (existing documents, resolutions or practices);
- c. To discuss and agree upon a consistent terminology for geodetic references and related understanding;
- d. To prepare recommended practices for the realization of each GNSS Geodetic Reference and its alignment to ITRF;
- e. To outline and encourage implementation plans in each relevant user community;
- f. To propose mechanisms for informing users of the current realization of a particular Geodetic Reference and any changes that may occur from time to time.

A similar Task Force has also been established on Time References. It is to be led by Felicitas Arias from the Bureau international des poids et mesures (BIPM). Both of those Task Forces will report to the ICG via Working Group D on Interaction with National and Regional Authorities and Relevant International Organizations. I am a Co-Chair of Working Group D along with John Dow and Ruth Neilan from IAG and the International GNSS Service (IGS).

A key part of the membership of the ICG is the so-called “Provider’s Forum”, which involves the providers of all of the major GNSS sub-systems, including:

- China: Compass/BeiDou Navigation Satellite System (CNSS);
- European Community: European Satellite Navigation System (Galileo) and European Geostationary Navigation Overlay Service (EGNOS);
- India: GPS and GEO Augmented Navigation System (GAGAN) and Indian Regional Navigation Satellite System (IRNSS);
- Japan: Quasi-Zenith Satellite System (QZSS) and MTSAT (Multi-functional Transport Satellite) Satellite-based Augmentation System (MSAS);
- Russian Federation: Global Navigation Satellite System (GLONASS) and Wide-area System of Differential Corrections and Monitoring (SDCM);
- United States: Global Positioning System (GPS) and Wide-area Augmentation System (WAAS).

On the first day of the meeting, all of the major providers gave presentations on the status and plans for their GNSS sub-systems.

The global user community for Global Navigation Satellite Systems (GNSS) was also represented with major players from many application areas. As well as FIG, international organizations represented in Pasadena included:

- Bureau international des poids et mesures (BIPM);
- International Association of Geodesy (IAG);
- International Association of Institutes of Navigation (IAIN);
- International GNSS Service (IGS, formerly International GPS Service), and;
- Office for Outer Space Affairs of the United Nations Secretariat.

Several companies and government organisations from the USA were represented in an exhibition attached to the meeting and many also gave interesting presentations in the open sessions of the ICG meeting. Those presentations are a very useful *snap shot* of the state of the art with the various GNSS and with issues across key user groups. I also gave a presentation based around a recent study into the economic benefits of precise positioning for the agriculture, construction and mining industries in Australia.

The Joint Statement compiled at the end of the week and the report from the Provider’s Forum have been included as attachments to this report. Those documents demonstrate the continuing and growing spirit of cooperation and transparency among the GNSS providers and I am confident that FIG’s involvement in the ICG will bring significant benefits in coming years for major GNSS user groups, including surveyors.

The Joint Statement, the Provider’s Forum report and all of the presentations made at the ICG-3 in Pasadena will also be available on the ICG Information portal in coming weeks (see www.icgsecretariat.org).

The next full ICG meeting (ICG-4) will be hosted by the Russian Federation in Saint-Petersburg, from 14 to 18 September 2009. The Committee also noted the offer of the European Community and Italy to jointly host the succeeding meeting in 2010.

Third Meeting of the International Committee on Global Navigation Satellite Systems (ICG)

8 – 12 December 2008, Pasadena, California

Hosted by the United States of America

Joint Statement

The International Committee on Global Navigation Satellite Systems (ICG) met in Pasadena, California, United States of America, from 8 to 12 December 2008, to continue further review and discussion on developments in global navigation satellite systems and to consider matters of interest to ICG by its members, associate members and observers. The International Committee also addressed global navigation satellite systems (GNSS) science and innovative technology applications and future commercial applications. Representatives from industry, academia, and governments shared views on GNSS compatibility and interoperability.

The meeting was hosted by the United States of America. Attendees included China, the European Community, India, Japan, the Russian Federation, the United States, Italy, Malaysia, Nigeria, the United Arab Emirates, and the following international organizations: the Bureau international des poids et mesures (BIPM), the Committee on Space Research (COSPAR), the Civil GPS Service Interface Committee (CGSIC), the European Position Determination System (EUPOS), the Fédération internationale des géomètres (FIG), the International Association of Geodesy (IAG), the International Association of Institutes of Navigation (IAIN), the International GNSS Service (IGS, formerly International GPS Service), and the Office for Outer Space Affairs of the United Nations Secretariat. The Canadian Space Agency (CSA) and the UN-affiliated Regional Centre for Space Science and Technology Education for Latin America and the Caribbean attended as invited observers. The IAG Reference Frame Sub-Commission for Europe (EUREF) also attended and was recognized by the International Committee as a new associate member.

The International Committee recalled that in its resolution 62/217 of 21 December 2007, the United Nations General Assembly noted with appreciation that the International Committee on Global Navigation Satellite Systems was established on a voluntary basis as an informal body to promote cooperation, as appropriate, on matters of mutual interest related to civil satellite-based positioning, navigation, timing and value-added services, as well as the compatibility and interoperability of global navigation satellite systems, while increasing their use to support sustainable development, particularly in developing countries, and that it held its first meeting in Vienna, in 2006, and its second meeting in Bangalore, India, in 2007.

The International Committee noted that the working groups focused on compatibility and interoperability; enhancement of performance of GNSS services; information dissemination and capacity building; and interaction with national and regional authorities and relevant international organizations and made substantive progress in furthering the ICG Workplan approved at the first meeting of the ICG organized by the Office for Outer Space Affairs of the United Nations Secretariat in Vienna in 2006.

The International Committee noted that the Providers Forum had adopted Terms of Reference and a Workplan. The report of the Third Meeting of the ICG Providers Forum is attached. The Plenary of the ICG affirmed also that the Regional Centres for Space Science and Technology Education, affiliated to the United Nations, will act as the ICG Information Centres. The International Committee further agreed to establish a Task Force on Geodetic References and a Task Force on Time References in order to promote progress in its Workplan.

The International Committee accepted the invitation of the Russian Federation to host the fourth meeting, to be held in Saint-Petersburg, from 14 to 18 September 2009. The Committee also noted the offer of the European Community and Italy to jointly host the succeeding meeting in 2010. The United Nations Office for Outer Space Affairs, as the Executive Secretariat of the ICG and the Providers Forum, will assist in the preparations for these meetings and interim planning and working group activities.

The ICG expressed its appreciation to the International GNSS Service (IGS), National Aeronautics and Space Administration's (NASA) Jet Propulsion Laboratory, the U.S. National Coordination Office for Space-based Positioning, Navigation and Timing, Trimble Navigation, Javad GNSS, Northrop Grumman, Lockheed Martin, and Rockwell Collins for their generous support. The ICG also expressed its appreciation to Stanford University, ONSTAR by General Motors, the National Science Foundation, the United States Geological Survey, the University Corporation for Atmospheric Research, United Airlines, SiRF, Inside GNSS Magazine and the Beijing BDStar Navigation for their participation.

ATTACHMENT**Report of the Third Meeting of the International Committee on
Global Navigation Satellite Systems (ICG) Providers Forum****Hosted by the United States of America****7, 11 and 12 December 2008, Pasadena, California****INTRODUCTION**

The Third Meeting of the Providers' Forum, consisting of three sessions on 7, 11 and 12 December 2008, was held in conjunction with the Third Meeting of the International Committee on Global Navigation Satellite Systems (ICG). China, India, Japan, the Russian Federation and the United States, as well as the European Community, were present at the Meeting. At the opening of the first session of the Providers Forum, introductory and welcoming remarks were made by Mr. K. Hodgkins of the United States.

The first session of the Providers Forum on 7 December 2008 reviewed the agendas and meeting procedures for the Providers Forum and the Third Meeting of the ICG, and discussed the Providers Forum Terms of Reference and its Workplan.

The second session of the Providers Forum on 11 December 2008 dealt with the ICG working groups' recommendations focused on issues related to system providers. The third session was held on 12 December and adopted the Terms of Reference and the Workplan of the Providers Forum.

The Terms of Reference and the Workplan of the Providers Forum are attached as Annexes to the present report.

ANNEX I

Terms of Reference of the International Committee on Global Navigation Satellite Systems (ICG) Providers Forum

A. Background

1. The International Committee on Global Navigation Satellite Systems (ICG) has been established on a voluntary basis as an informal body to promote cooperation, on matters of mutual interest related to civil satellite-based positioning, navigation, timing and value-added services, as well as the compatibility and interoperability of global navigation satellite systems, while increasing their use to support sustainable development, particularly in developing countries.
2. In response to a recommended action in the International Committee's Workplan, providers of global and regional navigation satellite systems and satellite-based augmentation systems proposed establishing a Providers Forum (PF) to enhance compatibility and interoperability among current and future systems. The first Providers Forum meeting co-chaired by the United States and India was held on September 4, 2007, immediately preceding the second meeting of the ICG. China, India, Japan, the Russian Federation and the United States, as well as the European Community, were present at the meeting.

B. Objectives

3. The objectives of the Providers Forum are to:
 - a. Promote compatibility and interoperability among current and future global and regional space-based systems by exchanging detailed information about planned or operating systems and the policies and procedures that govern their service provision, consistent with the template for information sharing among providers that was circulated prior to the first meeting;
 - b. Act as a mechanism to continue discussions on important issues addressed by the ICG that require focused inputs from system providers.
4. The forum is not a policy-making body, but provides a means to promote discussion among system providers based on agreed guidelines for provision of open services, including transparency, cooperation, performance monitoring, and spectrum protection; and agreed principles for ensuring compatibility and interoperability among systems.

C. Membership

5. The Forum will be open to States Members of the United Nations that are current and future GNSS providers. Current members and their respective systems are as follows:
 - a. *China*: Compass/BeiDou Navigation Satellite System (CNSS);

- b. *India*: Global Positioning System and Geostationary (GEO) Augmented Navigation System (GAGAN) and Indian Regional Navigation Satellite System (IRNSS);
 - c. *Japan*: Quasi-Zenith Satellite System (QZSS) and Multi-functional Transport Satellite (MTSAT) Satellite-based Augmentation System (MSAS);
 - d. *Russian Federation*: Global Navigation Satellite System (GLONASS) and Wide-area System of Differential Corrections and Monitoring (SDCM);
 - e. *United States*: Global Positioning System (GPS) and Wide-area Augmentation System (WAAS);
 - f. *European Community*: European Satellite Navigation System (Galileo) and European Geostationary Navigation Overlay Service (EGNOS).
6. Additional Members States who become GNSS service providers will be invited to join the Providers Forum upon consensus of the current members.

D. Organizational structure and procedures

7. During each meeting, the members, on the basis of consensus, will select a chair for the next meeting. The United Nations Office for Outer Space Affairs (UN OOSA), consistent with its role as the Executive Secretariat of the ICG, will also fulfil these responsibilities for the Providers Forum, in support of the chair.
8. The Forum will convene at least once every year in conjunction with the ICG annual meeting, and more often as needed. Actions and recommendations developed by working groups of the ICG that could impact the compatibility and interoperability, system development and operations, and/or service provision policies and procedures of GNSS providers will be of particular interest to Providers Forum. Therefore, the results of Providers Forum deliberations and consensus decisions on these issues and others will be reported to the ICG as appropriate and when possible, at the next scheduled plenary session of the Committee immediately following a Providers Forum meeting.
9. The Meetings of the Providers Forum will be organized by the chair and designated host, with support from the Executive Secretariat. Each member should designate its Principal and its additional points of contact.
10. Any recommendations resulting from Providers Forum meetings will be decided on the basis of consensus of its members.
11. Members will fund their own participation in the activities of the Providers Forum. Financial support (in-kind or direct funding) to the Executive Secretariat that is above and beyond the annual UN OOSA budget or existing funds provided for ICG Secretariat services will be provided by members on a voluntary basis.
12. The Providers Forum may revise these Terms of Reference on the basis of proposals made by members and adopted by consensus.

ANNEX II

Workplan of the International Committee on Global Navigation Satellite Systems (ICG) Providers Forum

In order to accomplish the objectives of the Providers Forum as described in the Terms of Reference, the members of the Providers Forum have agreed to pursue accomplishment of the following actions:

Promotion of Compatibility and Interoperability

1. The principles of compatibility and interoperability and their definition were adopted at the first Providers Forum meeting held in Bangalore, India, September 2007 (United Nations Document A/AC.105/901). The Third Providers Forum meeting, held in Pasadena, CA, USA, December 2008, updated these principles and their definition, as attached. The Providers Forum will continue to refine these principles of compatibility and interoperability and their definition.
2. The Providers will actively support the actions of the ICG working group on compatibility and interoperability focused on defining these principles from the perspective of various user applications and equipment manufacturers. This may require sponsoring and participating in workshops and meetings designed to solicit GNSS user input. It may also require elaboration of an approach for quantitative interoperability evaluation.
3. The Providers will draft individual reports on their respective planned or operating systems and the policies and procedures that govern their service provision, consistent with the template for information sharing.
 - a. The reports will be consolidated and maintained by the ICG Executive Secretariat on behalf of the Providers, and updates will be provided at least annually in preparation for each major meeting of the ICG.
 - b. The reports will emphasize each Providers current and planned efforts to ensure compatibility and interoperability among the global, regional, and augmentation system components of the global system of navigation satellite systems.

Open Service Information Dissemination

1. Consistent with the principle of transparency in the provision of open services, each individual Provider will strive to publish and disseminate all signal and system information necessary to allow manufacturers to design and develop GNSS receivers on a non-discriminatory basis.
2. Based on individual publication of open service signal information, the Providers Forum will consider developing a template for sharing and disseminating information from individual GNSS Open Service Signal Specifications and service standards.

Service Performance Monitoring

1. Providers will consider the development and discussion of proposals to widely monitor the performance of their open signals and provide timely updates to users regarding critical performance characteristics such as timing accuracy, positioning accuracy and service availability.
 - a. These discussions should focus on potential cooperation in the development of the necessary ground infrastructure to monitor signal and service performance for open services, recognizing that the actual implementation of this infrastructure is subject to the budgetary limitations of each system provider, and the completion of provider-to-provider agreements as necessary and appropriate.

Spectrum Protection - Interference Detection, and Mitigation

1. The Providers Forum will pursue the protection of radionavigation satellite service (RNSS) spectrum through appropriate domestic and international regulation. When necessary and appropriate, Providers will share their views on RNSS spectrum issues and related agenda items under consideration by the International Telecommunication Union (ITU) and its Working Parties.
2. In addition, the Forum will pursue the development of a strategy to detect and mitigate interference to GNSS worldwide by supporting the efforts of the ICG working group on compatibility and interoperability in this regard. This could lead to concrete proposals for detecting interference.

This Workplan will be reviewed on an annual basis and revised as necessary in order to address important issues that require the attention and focus of the system providers.

APPENDIX

Providers Forum Working Principles of Compatibility and Interoperability and their Further Definition

Global and regional system providers agreed that at a minimum, all GNSS signals and services must be compatible. To the maximum extent possible, open signals and services should also be interoperable, in order to maximize benefit to all GNSS users. For many applications, common carrier frequencies are essential to interoperability, and commonality of other signal characteristics is desirable. In some cases, carrier frequency diversity may be preferable to improve performance. The Providers Forum will continue to investigate the benefits of carrier frequency commonality and diversity, as well as compatibility and interoperability, as these latter terms are defined below.

Interoperability refers to the ability of global and regional navigation satellite systems and augmentations and the services they provide to be used together to provide better capabilities at the user level than would be achieved by relying solely on the open signals of one system.

- Interoperability allows navigation with signals from different systems with minimal additional receiver cost or complexity.
- Multiple constellations broadcasting interoperable open signals will result in improved observed geometry, increasing end user accuracy everywhere and improving service availability in environments where satellite visibility is often obscured.
- Geodetic reference frames realization and system time steerage standards should adhere to existing international standards to the maximum extent practical.
- Any additional solutions to improve interoperability are encouraged.

Compatibility refers to the ability of global and regional navigation satellite systems and augmentations to be used separately or together without causing unacceptable interference and/or other harm to an individual system and/or service.

- The International Telecommunication Union (ITU) provides a framework for discussions on radiofrequency compatibility. Radiofrequency compatibility should involve thorough consideration of detailed technical factors, including effects on receiver noise floor and cross-correlation between interfering and desired signals.
- Compatibility should also respect spectral separation between each system's authorized service signals and other systems' signals. Recognizing that some signal overlap may be unavoidable, discussions among providers concerned will establish the framework for determining a mutually acceptable solution.
- Any additional solutions to improve compatibility should be encouraged.